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Original paper

The development of SlowMo: How inclusive, user-centred design research can improve psychological therapies for psychosis

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Keywords

Inclusive design; user-centred design; participatory design; design thinking; mHealth; eHealth; digital therapy; severe mental health; paranoia; psychosis

Abstract

Background Real-world implementation of psychological interventions for psychosis is poor. Barriers include therapy being insufficiently usable and useful for a diverse range of people. User-centred, inclusive design approaches could improve the usability of therapy, which may increase uptake, adherence and effectiveness.

Objective To optimise the usability of an existing psychological intervention, Thinking Well, which targets reasoning processes in paranoia using a basic digital interface.

Methods We conducted inclusive, user-centred design research characterised by purposive sampling of ‘extreme’ users from the margins of groups, ethnographic investigation of the problem context, and iterative prototyping of solutions. The UK Design Council’s Double Diamond method was used. This consisted of 4 phases: *discover*, including a case series of Thinking Well, stakeholder interviews, desk research, user profiling, system mapping and a mood board; *define*, consisting of workshops to synthesise findings and generate the design brief; *develop*, involving concept workshops and prototype testing; and *deliver*, in which the final minimal viable product was storyboarded and iteratively coded.

Results Consistent with our previous work, the Thinking Well case series showed medium/large effects on paranoia and wellbeing, and small effects on reasoning. These were maintained at follow-up despite some participants reporting difficulties with the therapy interface. Insights from the *discover* phase confirmed that usability was challenged by information complexity and poor accessibility. Participants were generally positive about the potential of technology to be enjoyable, help manage paranoia and provide tailored interpersonal support from therapists and peers, although reported privacy and security concerns. The *define* phase highlighted that the therapy redesign should support monitoring, simplify information processing, enhance enjoyment and trust, promote personalisation and normalisation, and offer flexible interpersonal support. During the *develop* phase over 60 concepts were created, with two key concepts of thoughts visualised as bubbles, and therapy as a journey selected for storyboarding. The output of the *deliver* phase was a minimal viable product of an innovative digital therapy, SlowMo. SlowMo works by helping people to notice their worries and fast thinking habits, and encourages them to *slow down for a moment* to find ways of feeling safer. A webapp supports the delivery of eight face-to-face sessions, which are synchronised to a native mobile app.

Conclusions SlowMo makes use of personalisation, ambient information and visual metaphors to tailor the appeal, engagement and memorability of therapy to a diversity of needs. Feasibility testing has been promising, and the efficacy of SlowMo therapy is now being tested in a multi-centred randomised controlled trial. The study demonstrates that developments in psychological theory and techniques can be enhanced by improving the usability of the therapy interface in order to optimise its impact in daily life.

Introduction

The development of psychological interventions for psychosis has accelerated in the last two decades, particularly with the second and third-wave cognitive-behavioural therapies [1]. Whilst these show promise in reducing distress and improving people's quality of life, significant barriers to real world effectiveness remain [2,3]. Effect sizes are in the small to medium range, and psychological interventions are only accessed by 15-30% of eligible service users [4-8]. Some people are not motivated to try therapy, and those that do may struggle to understand it and to apply new insights to everyday situations [9-11]. Efforts to improve effectiveness have focused so far on identifying causal mechanisms linked to specific outcomes and developing therapy techniques that target these mechanisms [12]. For example, interventions for sleep, worry, self-esteem and reasoning styles have demonstrated larger effect sizes on paranoia compared to generic CBT for psychosis [13-15]. However, there is continuing concern about barriers to therapy access, uptake and adherence [5,12,16] and strategies for improving implementation are urgently needed.

We propose that enhancing the usability (or ease-of-use) of therapy will address implementation barriers and thereby improve effectiveness. To the best of our knowledge, this study is the first to focus on optimising the usability of an existing therapy (Thinking Well) by conducting inclusive, user-centred design research. Thinking Well is a brief protocol-based therapy that targets jumping-to-conclusions and belief inflexibility, the reasoning styles that contribute to paranoia [17]. We have already shown that this therapy improved reasoning and reduced paranoia in a case series, a randomised experimental study and two feasibility randomised controlled trials [10,18-20]. However, its effects declined following the end of therapy, and some people reported that the intervention was insufficiently personalised, enjoyable or applicable to daily life. Moreover, people with working memory problems and negative symptoms tended to benefit less from the therapy [10]. This may, in part, be due to the use of cognitive-behavioural thought records, a widely used tool for the identification and evaluation of distressing cognitions (Thought records can be cognitively demanding to complete, and their pen-and-paper, verbal format limits their usefulness in supporting real-world behaviour change [21,22]). Before proceeding to a multicentre randomised controlled trial, we therefore sought to optimise the usability of the intervention in order to address these concerns. The output of this study, SlowMo, is an innovative blended digital therapy for people who fear harm from others. A webapp supports the delivery of eight face-to-face sessions, which are synchronised to a native mobile app for use in daily life. SlowMo works by helping people to notice their worries and fast thinking habits, and encourages them to *slow down for a moment* to find ways of feeling safer. SlowMo is currently being tested in a multi-centre randomised controlled trial [23].

SlowMo reflects the rapid growth of digital technology in mental health care, given its potential to improve access, outcomes and costs [24-26]. In psychosis, findings indicate promising rates of acceptability, usability and safety for interventions delivered via the web, text messaging, smartphone apps and virtual reality. However, research is in its infancy and further development and testing is required [27-31]. Further, gender, age, ethnicity, severity of difficulties, digital literacy and social support may moderate adherence. This suggests interventions need to be tailored to the needs of a range of potential users [32-36]. Indeed, concerns about uptake and adherence are common in digital health interventions, given the marked overrepresentation among users of highly educated women. This highlights the need to ensure technology interfaces are more desirable, compelling and appealing across all groups in society [37].

Design thinking is a process whereby challenges to therapy access, uptake and adherence can be addressed. It involves developing a rich understanding of the problem area and its context in order to identify valued outcomes. From this, themes are derived to develop possible new ways of *framing* the problem by highlighting its paradoxes, and solutions are then generated to resolve them. For example, paradoxes that design thinking may help to resolve include a person's desire to be healthier whilst continuing to engage in unhealthy behaviours., or Government attempts to promote a sense of safety through authoritarian controls that actually exacerbate public perceptions that society is dangerous. Design thinking therefore involves an iterative process of identifying, refining and testing possible interventions (e.g. a product or service) and working principles of these interventions (e.g. the functionality and usability) to bring about the desired consequences [38,39]. It is particularly helpful for the innovation of 'wicked' (i.e. complex) problems. However, design thinking alone is insufficient to lead to meaningful change, as professional designers often operate outside problem contexts, and this may limit their ability to understand the problem and develop effective solutions.

The integration of user-centred design (UCD) into the design thinking process is therefore recommended, as UCD privileges empathic understanding of end users and their contexts, thereby ensuring solutions are relevant to the diverse needs of people involved [39-41]. *Participatory design*, or co-design, is a UCD technique that emphasises direct user involvement, and has its roots in activism and shared decision-making. It is increasingly used in digital mental health research, based on ethnographic and qualitative methods [42-44]. However, participatory design does not tend to incorporate the design thinking methodology of creating new frames to understand problems and their paradoxes and using these frames to generate solutions. This can arguably constrain innovation so that new designs are variations of the status quo. Further, a risk inherent in participatory design is that the most willing, able

and vocal users are more likely to be involved, so that the needs of marginalised people are neglected. To date, participatory design methods used in the development of digital therapies for psychosis have included investigation of stakeholder attitudes through observation, surveys, interviews and focus groups, workshops to develop and test prototype ideas, and laboratory-based ‘think aloud’ usability tests [45-53].

We further extended the application of design research to the area by integrating the best practice principles of design thinking and participatory design, supported by a multidisciplinary collaboration of people with lived experience, clinicians, researchers, industrial designers, and software developers. This involved using the Design Council’s [54] Double Diamond method and adopting an inclusive UCD approach. The Double Diamond consists of ethnographic investigation of the problem context, based on a suspension of assumptions about the nature of the problem and likely solutions (the *discover* phase), and using insights from this phase to reframe the problem and generate a design brief (the *define* phase). From this, solutions are generated and iteratively tested with users (the *develop* phase), with feedback determining the optimal design for development (the *deliver* phase). Our strategy for involving people in the design process, inclusive UCD, is different to conventional participatory design. It involves purposive ‘sampling’ of people at the margins of a ‘normal’ distribution (‘extreme users’) to ensure the design solution is suitable for the widest range of people (This purposive sampling of ‘extreme users’ can help to ensure the needs of marginalised groups are considered [55]. Further, it is assumed that, if the design solution meets the needs of people at the extremes of the distribution, it will also be suitable for ‘average’ users. Based on previous findings, we assumed demographics, cognitive abilities, use of technology, and attitudes to therapy were of particular relevance to the therapy design. We therefore aimed to ensure our sample of people with lived experience of psychosis reflected the extremes of these dimensions.

In summary, we anticipated that the inclusive, UCD research methods employed would support the development of an improved version of the Thinking Well intervention tailored to meet a diversity of needs. Our intention was that the design thinking approach would result in a redesign of the therapy that was more accessible, appealing, memorable and easy to use, both within sessions and in daily life.

Method

We conducted our design research alongside a case series of the previous version of the ‘Thinking Well’ therapy. This was done in order to support the discovery phase of the Double

Diamond. The case series will first be described, followed by an overview of the Double Diamond method. The design research was conducted from October 2014 until May 2017.

Thinking Well case series

Participants

Fourteen participants were recruited from community mental health teams in a NHS Trust between March 2014 and May 2015. Inclusion criteria were: a diagnosis of non-affective psychosis, aged 18-65 at study entry, with relatively stable symptoms and no major crisis within three months prior to participation, a sufficient level of English to complete measures and participate in the intervention, and a score of 33 or above on the Green Paranoid Thoughts Scale (GTPS) [56]. Exclusion criteria were: lack of capacity to provide informed consent, primary diagnosis of substance dependency, and a primary diagnosis of organic syndrome or learning disability.

Design

A case series design was used. Assessments were conducted at baseline, post-therapy (8 weeks) and follow-up (12 weeks).

Intervention

The case series used the fourth version of Thinking Well, which built on earlier iterations and aimed to incorporate the participant feedback from our previous trial (see [20] for a description of the preceding version of the therapy). This new version was developed before starting the inclusive UCD research. The changes included: presentation of therapy session materials in Powerpoint, on a laptop, to allow for more multimedia, interactive content; webpages hosted on a National Health Service website to support the use of therapy strategies outside of sessions; and use of everyday, accessible terminology for key psychological concepts. For example, the terms fast and slow thinking were introduced as a heuristic for capturing the ideas of jumping to conclusions and belief inflexibility, and analytical, reflective thinking, together with the focus on ‘slowing down for a moment’ as a means of managing worries [57]. Other changes, based on feedback from therapists in the previous trial, included extending the therapy content from four to six meetings, and adding sessions on the impact of past experiences and confirmatory bias in paranoia. While this version of Thinking Well was more digitised than previous versions, the software was not fully interactive. Pen and paper materials were still used during therapy sessions and offered for out-of-session use if people were unwilling or unable to use the webpages. Screenshots providing an example of the

therapy materials, taken from session one, are shown in Multimedia Appendix 1 (including Powerpoint slides used in the session with images of the paper thought record and practice card and the out-of-session webpages). Therapy was delivered by clinical psychologists with at least five years of experience in delivering cognitive-behavioural therapy for psychosis (CBTp) or therapists who had completed a post-graduate CBTp diploma and had a minimum of a year of post-qualification experience.

Measures

Positive and negative symptoms

The Scale for the Assessment of Positive Symptoms (SAPS) [58] is a 34 item, semi-structured interview used to assess the severity of hallucinations, delusions, bizarre behaviour, and positive formal thought disorder. Each item is rated over the past month from 0 (absent) to 5 (severe) with global ratings for each section. Negative symptoms over the past week were assessed using the Brief Negative Symptom Scale (BNSS), a 13-item semi-structured interview measuring blunted affect, alogia, asociality, anhedonia, and avolition, on a 7-point scale from 0 (absent) to 6 (severe) [59]. The SAPS and BNSS were only completed at baseline to assess the clinical characteristics of the sample.

State paranoia

The Green Paranoid Thoughts Scales (GPTS) [56] is a 32-item measure of state paranoia with sections on ideas of reference and persecution. Each item is rated over the past month from 1 (not at all) to 5 (totally) and a total score derived.

Paranoia distress and preoccupation

Participants were asked to rate their current distress and preoccupation regarding their main paranoia belief using 100-point visual analogue scales (VAS) ranging from 0 (not at all) to 100 (totally).

Paranoia conviction

Using a VAS, participants were asked to provide a rating between 0 (believe not at all) to 100 (believe absolutely) of their current conviction in their main paranoia belief.

Belief flexibility

Two items were employed to assess belief flexibility. *Possibility of being mistaken* was assessed using an item from the Maudsley Assessment of Delusions Scale (MADS) [60], with participants providing a rating from 0 to 100 to indicate if it were at all possible they may be mistaken in their belief. The Explanation of Experiences assessment [61] was then used to

explore whether the participant had any alternative explanations for their experiences contributing to their main paranoia belief.

Wellbeing

The Warwick-Edinburgh Mental Well-Being Scale (WEMWBS) [62] was used to measure participants' sense of wellbeing. This consists of 14 items, rated from 1 (none of the time) to 5 (all of the time), measuring the degree of positive emotions, fulfilling personal relationships, and sense of agency experienced by participants. A total score is derived, with higher scores indicating more wellbeing.

Therapy feedback

A semi-structured interview schedule was used after each therapy session and at the end of therapy to elicit feedback regarding acceptability, usefulness and usability.

Analysis

Feedback interviews are summarised descriptively. As this case series was primarily conducted to support the design research, and not powered to detect significant effects, the focus of the results is not on significance testing. However, to support comparison with our previous work, we report Cohen's D standardised effect sizes for continuous outcomes, calculated as the difference in the mean between two time points divided by the standard deviation of the change.

Inclusive, UCD research

An overview of the design research methods used at each phase of the Double Diamond are shown in Figure 1 and will be further described below.

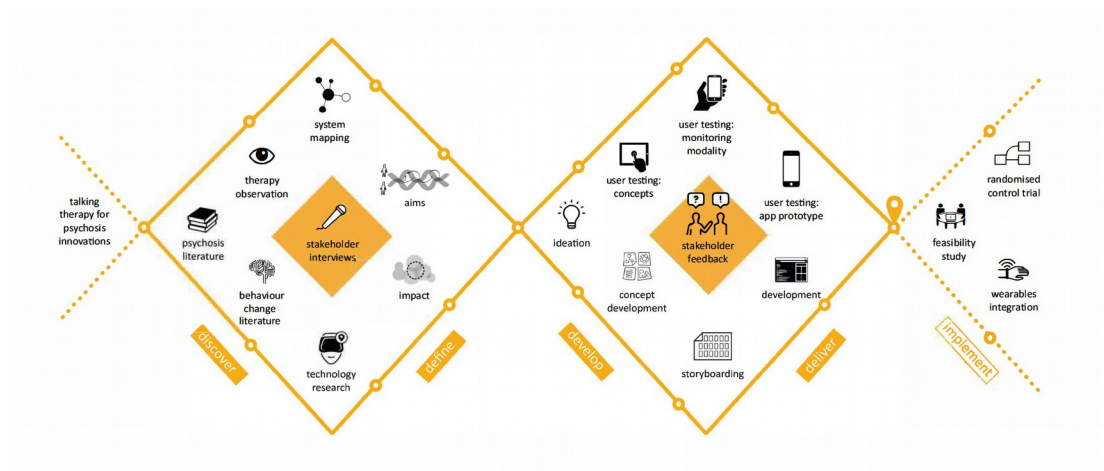


Figure 1. The design research methods used at each phase of the Double Diamond to develop SlowMo therapy.

Discover

The aim of this phase was to develop a shared understanding of psychological therapy, behaviour change, psychosis, and technology use from the perspective of service users, carers, therapists and clinicians. This phase is ‘divergent’ in its approach as it explores the subject matter from a variety of viewpoints. It started with desk research covering empirical studies, self-help books, therapy manuals, lived experience narratives, computer games and gameification. The lead designer (AW) did live and taped observations of the Thinking Well case series, and for comparison, taped observations of two cases of a therapy targeting anxiety processes in paranoia. Six service users were interviewed about topics including their daily habits, therapy experiences, attitudes towards therapy, and technology preferences. Therapists were shadowed in their service contexts to gain insight into their roles and service user journeys through the system. Following these tasks, user profiles of prototypical service users and therapists were created, together with mapping of the contexts in which therapy is delivered. Methods for illustrating and visualising thoughts and emotions were also explored to identify the most intuitive ways of communicating them. This included research into areas such as art, visual communication, symbolism, music, movement, and dyslexia.

Define

The define phase is ‘convergent’ in its approach, aiming to refine and re-frame the breadth of insights emerging from the ‘discover’ phase. This consisted of workshops to synthesise the research insights into themes and identify the most salient areas for improving mental health care in psychosis. A matrix of service user and clinician needs in relation to the therapy was developed, with each need rated according to potential impact and ease of implementation. Based on these insights a design brief was developed, specifying the desired area of impact and aims for the redesign.

Develop

The develop phase resumed a divergent process which focused on creating a wide range of ideas for addressing the design brief. At the beginning of the develop phase, concepts to address the design brief were generated, developed, evaluated and refined by the project designers, technologists and psychologists. Prototypes of the selected concepts were then made, and validated with service users. Prototypes for different modalities of monitoring worries were also explored.

Deliver

The ‘convergent’ deliver phase consisted of refining the breadth of concepts generated in the ‘develop’ phase. The selected concepts for therapy redesign were finalised and storyboards developed. The new version of the design was iteratively produced through rapid prototyping in software code, with user testing of a low fidelity version of the therapy redesign. This resulted in the final minimal viable product.

Results

Thinking Well case series

Forty-five service users were referred: 12 were unsuitable prior to screening, four declined to meet, five did not meet the cut-off score for paranoia, and 24 were suitable. Four service users disengaged between screening and consent, and 20 service users consented to participate. Of those consented, six disengaged during the baseline assessment. Fourteen participants were included in the case series, two dropped out and 12 completed the intervention. One of the participants who dropped out experienced a relapse in mental state that was assessed as unrelated to participation in the study, and the other disengaged from therapy. No other adverse events were reported. All participants who completed the intervention did the post-therapy assessment and ten completed the 12-week follow-up assessment. One participant was not contactable as they had moved out of the area, and the other was not able to attend due to new personal commitments.

The case series sample demographics are presented in Table 1, and the outcome data and summary statistics in Table 2. Inspection of the descriptive statistics and effect sizes indicates there were improvements in all measures post-therapy and follow-up, relative to baseline. These were in the medium-large range for paranoia and wellbeing, with small-medium effects on reasoning variables. The results were maintained at follow-up, in contrast to our previous findings [23] where effects reduced at follow-up on all key outcomes. This suggests

the extension of the therapy from 4 to 6 sessions was useful, together with an increased focus on multimedia content and normalising, accessible language. Table 3 shows themes arising from the therapy feedback, including experience of the therapy, strategies for feeling safer and suggestions for improvement. Participants indicated the therapy was helpful in supporting the learning of slow thinking strategies and they valued the digital presentation of materials in sessions. They also wanted less verbal information and more interactive and accessible content.

Table 1. Thinking Well case series sample demographics (n = 12).

Variable		Mean/n (%/SD)	Range
Sex	Age (years)	43.83 (11.40)	
	Male	5 (42)	
	Female	7 (58)	
Ethnicity	White British	7 (58)	
	Black British	2 (17)	
	Black African	1 (8)	
	Afro-Caribbean	1 (8)	
	Black Caribbean and white	1 (8)	
Marital status	Single	9 (75)	
	Married	3 (25)	
Employment status	Unemployed	8 (68)	
	Carer/housewife	1 (8)	
	Employed	1 (8)	
	Volunteer	1 (8)	
	Student	1 (8)	
SAPS positive symptoms	Hallucinations	2.23 (2.20)	0 - 5
	Delusions	4.00 (0.58)	3 - 5
	Bizarre behaviour	0.08 (0.28)	0 - 1
	Formal thought disorder	1.00 (1.16)	0 - 3
BNSS negative symptoms	Anhedonia	1.18 (1.20)	0 - 4
	Lack of normal distress	0.31 (0.75)	0 - 2
	Asociality	1.42 (1.66)	0 - 6
	Avolition	1.23 (1.28)	0 - 4
	Blunted affect	1.21 (1.23)	0 - 5
	Alogia	0.65 (1.11)	0 - 4

Table 2. Case series paranoia, wellbeing and thinking habit outcomes.

	Baseline		Post (8 weeks)			Follow-up (12 weeks)		
	(n = 12)		(n = 12)			(n = 10)		
	Mean	SD	Mean	SD	Cohen's D	Mean	SD	Cohen's D
GPTS	105.50	17.40	91.33	28.49	0.59	89.90	37.19	0.44
VAS	79.58	16.16	61.67	34.00	0.61	58.80	37.30	0.75

distress								
VAS	70.58	25.46	62.92	30.56	0.50	55.00	31.97	0.75
preoccupation								
WEMWBS*	39.13	2.80	42.55	7.84	0.71	43.22	9.38	0.40
VAS	75.42	29.65	56.83	32.91	0.67	55.00	37.11	0.63
conviction								
VAS	36.36	37.69	41.75	35.78	0.12	46.50	34.32	0.20
possibility of being mistaken †								
	n	%	n	%		N	%	
n with ≥ 1 alternative explanations	4	33.3	6	50.00	-	8	80.00	-

*Baseline n=8, post n=11, FU n=9

† Baseline n=11

Table 3. Case series therapy feedback.

Theme	Comments
Experience of therapy interface	<p>More helpful than talking therapy because it had the computer programme. I felt comfortable rather than worried I wouldn't know what to say.</p> <p>The computer is a good idea, and the therapist is also helpful. Videos, liked the visual representation of how events can change mood and thinking.</p> <p>Comfortable. I'm not too good at talking but with someone who knows what they're talking about it helps bring it out. Useful, interesting, moving and relevant.</p> <p>I found it friendly and relaxing.</p> <p>Don't like the writing – I prefer the therapist to write.</p> <p>I found it quite hard because I had to think more.</p>

Strategies for feeling safer	<p>Using the coping cards, photographing them so I have them on my phone. Trying to practise to keep it in mind.</p> <p>Slowing down and thinking that it could be something else.</p> <p>Looking at the coping cards. Carrying my coping card around.</p> <p>Breathing techniques.</p> <p>Looking for evidence, trying to think outside the box and looking for alternatives.</p> <p>Thinking slow. Just thinking I might be mistaken.</p> <p>Thinking about things before making a decision, coming to the most logical conclusion, playing a lot of football.</p> <p>Dwelling less, doing more with friends and family, slowing down, and looking for more information.</p> <p>Going to day centre, getting support from members and staff, trying to do things to distract me.</p> <p>Different ways of looking at things and relaxing more.</p> <p>The suspicions come up, but they don't escalate cause I've got tools I can reach for.</p> <p>Finding that people look at me, but it doesn't mean anything.</p> <p>Strangers look at strangers.</p> <p>Learning how to look at alternative ways of what is going on in particular situations.</p>
Suggestions for improvement	<p>More videos – they are a good visual aid and more relatable.</p> <p>Oyster card wallet that contains the cards to help people remember the coping strategies. An app: offline app. Getting people together to say what they've learnt, even just at the end.</p> <p>Need more practise; have cards close at hand.</p> <p>More interactive things...and more interactive scenarios to help practise other explanations.</p> <p>Examples of other people's past experiences and how they affect them.</p> <p>More videos and examples.</p>

All participants were offered the opportunity to register for the website which hosted the therapy webpages. Of the 12 participants in the case series, all expressed an initial interest and four completed registration. Of these, three never accessed the webpages and one person logged on once, with support from their therapist. Participants were asked about their reasons for not accessing the webpages at the post-therapy assessment (see Table 4). Responses indicated that the website was too difficult to access due to it only being available on a computer, involving complex login instructions, and having an unappealing user interface. This suggested that whilst people were positive about the use of technology, the basic webpages were not helpful in improving the therapy experience.

Table 4. Case series webpages feedback.

Theme	Comments
Hardware accessibility	They were too difficult to access, the website was only available on a computer and I don't have one. It was too much effort to go to the drop-in sessions that the trust hosted to use the website.
Software accessibility	It meant finding the handouts, getting to a computer, and writing in the address to access the website, as well as a number of instructions just with the welcome pack, it's asking a lot of effort. The password got sent separately by post, I lost it.
User interface	It was difficult to remember how to use. Interface was not user friendly or self-explanatory. Finding things on the page was difficult even once I'd managed to login.

Design research

The key insights and outputs from each phase of the Double Diamond will be described below. The characteristics of the 18 participants in the design research sample are shown in Table Five. The sample included all the participants who completed the case series, the participant who disengaged from the case series and five participants who were purposively recruited to improve the extent to which the sample represented the extremes of our target sampling characteristics (i.e. demographics, digital literacy, cognitive abilities and relationship to therapy). As detailed in Table 5, involvement in the design research tasks varied across participants. Participant selection from the sample was based on the task needs, which developed iteratively as the project progressed, together with participant availability within the design research schedule.

Table 5. Design research sample characteristics.

No.	Background	Cognitive abilities	Use of and attitude to technology	Attitude to therapy	Design research methods
1	M, 60, Black Caribbean, unemployed, single, lives alone	No reported difficulties.	Has basic mobile phone. Not confident in using. Interested in improving	Views as supportive and useful, finds difficult to apply to daily life due to physical health problems and	Interview

2	F, 53, Black African, unemployed, single, lives alone	No reported difficulties.	skills. Has basic mobile phone. Confident in using. Interested in improving	motivation. Views as supportive, not sure if useful as finds difficult to apply to daily life due to substance use problems and life stresses.	Interview
3	M, 23, White British and Black Caribbean, employed, single, supported housing	Reports mild difficulties with attention and memory.	skills. Has smartphone and laptop. Frequent and competent use.	Views as supportive and possibly useful, finds emphasis on verbal information and paper tools frustrating and not accessible in daily life.	Interview and taped observation
4	M, 30, White British and Black African, student, single, supported housing	No reported difficulties, mildly disorganised speech.	Has smartphone. Frequent and competent use.	Views as supportive and useful, finds emphasis on verbal information and paper tools frustrating and not accessible in daily life.	Interview and taped observation
5	M, 62, Black Caribbean, unemployed, single, no fixed abode	Moderate-severe cognitive difficulties in attention, reasoning, memory and comprehension.	Sometimes has basic mobile phone, not confident in using. No interest in improving skills.	Views as supportive, although ambivalent about usefulness and if relevant to his situation. Significant difficulties with learning and applying therapy insights.	Live observation of therapy
6	F, 47, White British, unemployed, cohabiting with partner	No reported difficulties.	Has basic mobile phone, confident in using. No interest in	Views as supportive and useful, finds emphasis on verbal information and paper tools frustrating and	Taped observation of therapy

			improving skills.	not accessible in daily life.	
7	F, 45, White British, voluntary work, single, lives alone	No reported difficulties.	Has basic mobile phone. Not confident in using. Interested in improving skills.	Views as supportive and useful, able to apply insights to daily life, although struggles when more distressed.	Taped observation of therapy
8	M, 44, Afro-Caribbean, unemployed, single, lives with parents	Moderate–severe difficulties with attention, reasoning, memory and language production	Has never used mobile phone or computer. Interested in improving skills.	Views social contact as supportive, although ambivalent about usefulness and if relevant to his situation. Significant difficulties with learning and applying therapy insights.	Taped observation of therapy
9	M, 63, White British, unemployed, single, lives alone	No reported difficulties.	Has never used mobile phone or computer. No interest in improving skills.	Views as supportive and useful, and able to apply insights to daily life.	Taped observation of therapy
10	F, 39, Black African, housewife, lives with husband and children, English second language.	Mild difficulties with attention, reasoning and memory due to voices.	Has basic mobile phone. Confident in using. Interested in improving skills.	Views as supportive, unsure if useful and applicable to her situation.	Taped observation of therapy
11	F, 36, White British, unemployed,	Mild difficulties with	Has smartphone and laptop.	Views as supportive and useful, and able to apply insights to daily	Taped observation of therapy

	lives with husband, English second language.	attention, reasoning and memory due to voices, visions and somatic sensations.	Frequent and competent use.	life.	
12	F, 26, Black British, unemployed, single, lives alone	Moderate difficulties in attention, reasoning and memory due to voices, visions and somatic sensations.	Has smartphone and laptop. Frequent and competent use.	Views as supportive and useful, and able to apply insights to daily life.	Taped observation of therapy
13	M, 28, Black Carribean and White British, student, single, lives with parents	No reported difficulties, above average skills.	Has smartphone. Not confident in using. Interested in improving skills.	Ambivalent about usefulness and whether applicable to his life. Able to apply insights to daily life.	Taped observation of therapy
14	F, 51, White British, employed, in relationship, lives alone	No reported difficulties, above average skills.	Has smartphone and laptop. Frequent and competent use.	Views as supportive and useful, and able to apply insights to daily life.	Taped observation of therapy
15	F, 50, Black British, unemployed, single, lives with adult son	No reported difficulties.	Has smartphone and laptop. Frequent and competent use.	Ambivalent about whether usefulness and whether applicable to her life. Able to apply insights to daily life.	Interview, taped observation of therapy, concept prototype, narrative prototype,

					low fidelity
16	F, 29, Indian and Black Caribbean, student/volunteer, single, lives alone	Mild difficulties with attention, reasoning and memory due to voices, visions and somatic sensations.	Has smartphone and laptop. Frequent and competent use.	Views as supportive and useful and able to apply insights to daily life, although impact limited due to social circumstances and intense distress.	prototype. Interview, concept prototype testing, modality prototype testing, low fidelity prototype testing.
17	M, 37, White British, unemployed, single, lives alone	Mild difficulties with attention, reasoning and memory.	Has smartphone. Not confident in using. Interested in improving skills.	Views as supportive and useful, finds it difficult to apply insights to daily life as struggles to remember when distressed.	Live observation of therapy, concept prototype testing, modality prototype testing, low fidelity prototype testing.
18	M, 62, White British, unemployed, single, lives with a friend	Moderate difficulties with attention, reasoning, memory and language production.	Has basic mobile phone. Not confident in using, interested in improving skills.	Views as supportive, finds it difficult to understand content and apply in daily life due to cognitive difficulties.	Live observation of therapy, concept prototype testing, modality prototype testing, low fidelity prototype testing.

Discover

Multimedia Appendix 2 contains the processes and outputs during the discover phase including process map of therapy sessions, mapping of the broader multidisciplinary service context, service user journeys, user profiles, a mood board reflecting the communication of thoughts and emotions, and a table summarising the five salient themes arising from this phase, illustrated by comments from the participant interviews. These five themes were validated against the insights arising from the therapy observations, service shadowing and context mapping.

The first theme concerned challenges to the usability of therapy. Service users and therapists struggled to manage information processing and communication demands, given the amount and complexity of the therapy materials. This limited the potential impact of therapy on people's lives. As a result, adaptations were made to make the materials more concise and accessible, such as personalising the content and using mobile phones to record therapy strategies. The second theme related to technology use. Concerns about digital literacy and privacy were frequent, although these often occurred alongside a desire to integrate technology into therapy and improve digital skills. A wish to progress and to document achievements using technology was also highlighted. Enjoyment was the focus of the third theme, with a consensus that interactive, gameified tasks and visual materials were the most enjoyable aspects of therapy. The next theme related to the therapy relationship. Feedback in this area reflected some people valuing the support from their therapist, with others being less committed to or avoidant within the relationship. The final theme was about interpersonal support from others experiencing similar difficulties. Service users varied as to what level of support they would find useful, ranging from accessing previously recorded stories and suggestions, to more active involvement in digital or face-to-face support groups.

Define

The define phase involved defining the design brief, based on the insights from the discover work. A number of possibilities for the therapy redesign were identified including family and carer involvement, social inclusion, peer support and self-help. The areas of impact that appeared most relevant to improving usability were optimising therapist and service user time within and between sessions, and improving self-monitoring and self-management in daily life. The design brief was then generated by identifying the factors that could paradoxically limit how useful the therapy was during and outside of therapy sessions (i.e. the problem

paradox). The design brief therefore specified that we aimed to develop a digital platform to support the therapy process by:

1. Supporting people to notice their thoughts and thinking habits.
2. Presenting information in a simple and memorable way.
3. Being enjoyable and trustworthy.
4. Promoting personalisation and normalisation.
5. Helping people feel more supported *and* independent.

Develop

Multimedia Appendix 3 illustrates the key processes and outputs during the develop phase including concept generation, concept development, concept evaluation, narrative prototypes, modality prototypes and participant feedback on the prototype testing. The develop phase commenced with creative workshops involving clinicians, industrial designers and game developers. Based on the design brief, we generated concepts for optimising each therapy session and the time between sessions. Sixty concepts were suggested, which were grouped by theme resulting in eleven overarching concepts. These were then subject to further concept development by detailing what the therapy could look like if it were designed according to the concept. The developed concepts were then rated according to ease of implementation, likely impact, and appeal. Based on these ratings, three concepts were selected for narrative prototype testing. These concepts were: bubbles, where thoughts are visualised as bubbles that can be influenced by our actions; journey, where therapy is framed as an incremental process with challenges and achievements; and interaction, which focused on providing simple, habitual tools for dealing with worries.

The selected concepts were prototyped digitally (using the proto.io platform) and validated by presenting them to participants on a tablet. The validation process focused on both participants' verbal reports and their behaviour in relation to the prototypes. The concept of illustrating thoughts as bubbles resonated strongly. Participants displayed positive affect and approach behaviour responses. Importantly, with regards to the aims of psychological therapy the metaphor helped them see their thoughts as transient and separate from the self. They noted that bubbles could have different sizes depending on their intensity, and that their movement, speed and colour could reflect different thinking patterns and styles. Participants also liked the idea of therapy represented as a journey, where each session is characterised by new experiences guided by their digital avatar who interacts with other characters along the way. The interaction prototype was less appealing to users, who had a neutral or confused affective response, and commented that it felt too abstract and oversimplified their problems.

Bubbles and journey were therefore selected as the design concepts for framing the therapy redesign.

The second prototype testing explored the uptake and usability of different modalities for monitoring thoughts (text questions, camera, voice recorder and counter) using a design probe. Participants were given a basic smartphone with the prototype installed for them to use over a week. They were told to use the prototype as they wished in order to explore if and how they engaged in using the smartphone to monitor their worries. At the end of the testing period, daily data indicated 87% usage for the text questions, 50% usage for the voice recorder and counter, and 34% for the camera. This suggested a preference for simple text as the main monitoring modality, although it was notable that the voice recorder and counter were also used, despite being considerably harder to access on the phone's interface. Further, participants reported a mean rating of 73% for enjoyment, 61% for usability and 85% for acceptability on a 10-item User Experience Survey (adapted from [49]) designed specifically for the testing. Participant feedback showed that monitoring was viewed as valuable and enjoyable, and easier in the digital modality than using pen and paper materials. Unsurprisingly given the basic, unintuitive handset, participants noted the prototype was quite difficult to use. There were further concerns about privacy and impact on paranoia. All participants wanted more support from the phone to manage their worries.

Deliver

Wireframe storyboard development

In the deliver phase, wireframe storyboards of the session and out-of-session content were developed based on the selected concepts, and then iteratively coded alongside user testing. All of the session content from Thinking Well was incorporated, with a redesigned interface and functionality. An analogue aesthetic (i.e. life-like illustration) was used throughout, to provide an accessible, friendly design for people less willing and able to use technology. The use of written text was significantly reduced and replaced with short audio files or simple visual displays. Haptic interactions were used where possible to promote engagement, enjoyment and memorability. The mobile app was designed so that people could use it without the keyboard if they wished, improving accessibility for those less digitally literate. The flow through the interface was designed to increase the likelihood of sustained engagement and completion of therapeutic tasks. For example, 'next' buttons were made more visually salient than 'back' or 'exit' buttons, so that users were more likely to tap them and sustain their engagement.

Rapid prototyping and testing also explored the aesthetic of the bubbles used to visualise thoughts and thinking habits, given that they represented a unifying visual language in the therapy. Based on the design research insights, a balance was sought between an appealing appearance that increased the likelihood of people wanting to use it and a wish not to invalidate their concerns. It was anticipated this would help people to see their thoughts as less threatening and separate from themselves. Visual attributes (e.g. size, movement and colour) and ways of interacting with the bubbles (e.g. scaling, tapping, moving, popping) were investigated as a way of communicating information about the nature of thoughts and how we can relate to them. It was decided that the size of the bubble would reflect the intensity of the thought, while the speed at which it spins would illustrate the associated thinking habit. Worries are shown as grey bubbles, safer thoughts or other strategies for feeling safer are displayed as coloured bubbles and worries which the person has ‘slowed down’ are given a coloured halo. A finger tap was chosen for selecting a thought and its colour, with scaling used to alter the bubble size or spinning speed.

The therapy name, SlowMo, was the product of a brainstorming workshop with designers, psychologists and software developers. Workshop participants were given the aim of finding a name that would appeal to both service users and therapists, that communicated the essence of the therapy, that was phonetically engaging and memorable, and that could function within the clinical context (e.g. when clinicians were referring service users or in therapy discharge reports). Popular digital brand names were reviewed for inspiration, and name concepts generated based on the themes of ‘care and compassion’, ‘feeling safe and calm’ and ‘tools and superpowers’. Over 200 concepts were developed; each participant selected their favourites, which were then reviewed. SlowMo was selected, supported by the tagline ‘slow down for a moment’.

SlowMo: minimal viable product

The SlowMo platform is shown in Figure 2. The wireframed storyboards were iteratively coded alongside user testing to produce this minimal viable product. Multimedia Appendix 4 shows screenshots from the therapy sessions, and Multimedia Appendix 5 contains screenshots from the out-of-session mobile app. SlowMo consists of eight individual, face-to-face sessions, lasting 60 – 90 minutes, which are supported by a webapp delivered on a laptop or tablet. When a person starts therapy, a unique user profile is set up which is linked to an identification code. No personally identifiable information is required by the system. The identification code allows the user-entered data to be stored on the webapp, which is then synchronised during sessions to a native, android app for use in daily life. It was decided to use the identification code and native app as a way of minimising concerns about privacy and security. People may also choose to not link the app to their user profile so that no data are transferred. Another advantage of the native app is that it minimises financial costs as no internet connection is required, ensuring it has minimal provider costs and is thus accessible to users on a low income.



Figure 2. SlowMo therapy.

SlowMo webapp: minimal viable product

The webapp has a fixed structure to support fidelity and adherence, although content can be skipped to allow tailoring of the material to the person's cognitive needs. The webapp is used as a stimulus for discussion between the therapist and service user, although if the service user prefers the interface can still support learning with reduced therapist input. The journey concept is used to anchor the therapy. During set-up, people select an avatar to represent them on their therapy journey and input a chosen name (which can be their first name, or a pseudonym if they prefer). The homescreen then displays the person's journey through therapy, from which individual sessions can be accessed. The journey home screen also contains a destination signpost where people enter their personal valued goal for the therapy. As with previous versions of the therapy, initial sessions involve building the meta-cognitive skill of noticing thoughts and thinking habits. People learn that whilst fast thinking is common and can be useful, slow thinking can be helpful in dealing with stress and worries about other people. This principle is expanded in subsequent sessions by covering a new topic area and a related 'slow down for a moment' tip (each of which have an associated colour). The session topics are shown in Table 6. With some exceptions in sessions one and eight for initial and final tasks, sessions follow a consistent format of monitoring progress, reviewing the formulation (i.e. an overview of triggers, worries, impact of worries and alternative safer thoughts), collaborative agreement of session aims, psychoeducation, normalisation, experiential tasks to personalise learning, recording of key learning, practice with the SlowMo native app, and documenting a goal for the week.

Table 7. SlowMo webapp sessions

Session	Topic
1	Notice your thoughts
2	Notice your thinking habits
3	Slow down for a moment
4	Slow down: what's your safer thought?
5	Use a safety strategy
6	Slow down: past experiences
7	Slow down: pop the worry
8	Make a habit of slowing down

The interface for these tasks was developed in line with the design brief. Progress is monitored through scaling the visual appearance of bubbles (size for intensity, spinning speed for thinking habit, and transparency for conviction) to be more appealing and reduce the reliance on numerical rating and graphs. A formulation of people's difficulties detailing triggers, worries, impact on life and helpful thoughts and strategies is developed in session one, using the visual language of bubbles. This is pulled through to remaining sessions, and can be easily updated as new insights, difficulties and ways of coping emerge. The potential aims are communicated through interactive boxes that are tapped to reveal their content, in

order to be more engaging, memorable and provide a shared understanding of the session structure. Psychoeducation information is presented with brief audio messages paired with illustrative animations. Three characters with prototypical experiences of paranoia share their stories as the therapy progresses. Their function is to provide normalising messages about fears of harm from others (e.g. that they are common in the general population), and to model how the SlowMo tips can be used to make sense of worries and feel safer. Experiential learning tasks are designed to optimise personalisation and implementation in daily life, for example, by exploring the impact of fast thinking on daily life or by practicing the application of the SlowMo tips to worries selected from the formulation. Text or audio recordings are then made of the most important learning points from the session and of a note outlining a goal or key message for the week to support the person in making use of the therapy strategies. The learning messages are pulled through to the final session to support a personalised review of the therapy, from which the individual can choose a customised selection of the SlowMo tips for use after the end of therapy.

SlowMo native app: minimal viable product

There is an emphasis throughout the intervention on practising skills inside and outside sessions, with the SlowMo native app providing a bridge between the therapy meetings and everyday life. The app works by unlocking new content towards the end of each session, based on the learning topic covered in the webapp. This new content is reviewed in session, and where possible the therapist supports the person to practice the use of the app outside the consulting room. The home screen has two viewing modes, one displaying worries and the other 'feeling safer' thoughts and strategies. When the app is in online mode, the home screens are synchronised from the webapp formulation. Thus, in the first session, the home screens automatically populate from the data inputted to the formulation, which consists of the person's worry bubbles. People are then encouraged to use the app to identify their worries over the next week, given that monitoring is a necessary first step for self-management. When they experience a worry, they tap the associated bubble to record its occurrence and then size the bubble to indicate how distressing it is. Additional worries and strategies can be entered onto the app home screen, which will synch to the webapp formulation at the beginning of the next session. An additional screen is unlocked on the app during session two, where the thinking habit associated with the worry is rated by spinning the bubble faster or slower. From session three, a 'slow down' screen is added to the process, which displays a spinning bubble. This slows down when tapped, to act as a cue to 'slow down for a moment' in order to manage worries. From session four onwards, additional strategy prompts or tips are provided on this screen, based on the topic covered in the session. When a user selects a tip, a halo corresponding to the tip colour appears around the grey

worry bubble, providing visual feedback that a helpful slowing down idea has been identified. Following the slow down screen, there is an option to record useful new information by way of audio or text and then select an alternative safer thought or strategy. The user finally re-rates the distress associated with the worry, to evaluate the impact of slowing down.

Data is stored in a format whereby, when experiencing recurrent concerns, people can readily access what was previously helpful. When a worry is tapped on the home screen, this will initially access a 'thought profile' page, from which users can either enter the slowing down process, or see a summary of previous occasions when they have slowed the thought down (i.e. the selected tip, information recording, safer thoughts, and pre- and post-distress rating). Another option is to access a list of all the tips that have been liked in relation to the thought. In addition, the burger menu of the app sequentially unlocks a brief summary of each session (under a 'My journey' option) to act as an aide memoire for session content (i.e. the slowing down tip, the message to self, the most important learning point, and monitoring ratings). The burger menu also consists of 'Settings', where the offline mode can be selected, and at the end of therapy an option is unlocked to allow the selection of slowing down tips. The burger menu also contains an 'About SlowMo' section that briefly details the background to the development of SlowMo, and privacy and security information. A 'My safety plan' section advises users what to do in a crisis, and provides an option to insert crisis contact numbers. Finally, optional notifications are available if people wish the app to provide prompts to encourage slowing down.

Technology platform

The software development work was done by Evolyst Ltd., a user-centred and evidence-based health care software development company, informed by the British Standards Institute quality criteria and code of practice for health care apps [63]. SlowMo uses a proprietary software platform developed using an Azure-based WCF (Windows Communication Foundation) Web Service, acting as an Application Programming Interface (API) to a Model View Controller (MVC) Asp.Net Web application; and a Xamarin.Android-based mobile application, allowing for use of the full Microsoft Stack and negating interoperability issues. SlowMo has currently been developed as a standalone product, given the lack of consensus on operating systems across the NHS trusts, and current interoperability issues.

Discussion

This study is the first to employ inclusive UCD methods within a design thinking approach to optimise the usability of an existing therapy for psychosis, Thinking Well. In the case series

of a newly extended version of Thinking Well, we found indications of sustained medium-large effects on paranoia and wellbeing, and small-medium effects on reasoning post-therapy and at 12-week follow-up. However, obstacles to the intervention interface were noted, underscoring the need for the design research. We met the design study objective by producing a blended digital therapy, SlowMo. An intuitive webapp augments the experience of face-to-face therapy sessions, which is synchronised with a native mobile app for self-monitoring and management in daily life. By adding an app to the therapy, we hope to optimise its reach beyond the consulting room. The app's functionality includes an innovative redesign of a thought record, a widely used cognitive-behavioural therapy tool, which could be useful for other mental health difficulties. We adopted a novel approach to service user involvement, *inclusive UCD*, to ensure a wider range of people were involved in the therapy development than in conventional participatory design. The application of inclusive UCD to the therapy interface may improve adherence, thereby increasing the likelihood of delivering benefit in real-world settings [64]. However, SlowMo requires further testing of its usability and usefulness. A feasibility study of the native app has been completed, with promising findings, while SlowMo's overall effectiveness and the adherence and usage of both the webapp therapy sessions and the mobile app are currently being investigated in a multi-centre randomised controlled trial [23]

The inclusive UCD research identified the ways in which the intended benefits of therapy may paradoxically not be realised. This led to a reframing of the desired outcomes beyond reducing distress and improving quality of life [38,39]. Our participants confirmed the importance of digital therapy being usable, memorable, trustworthy, enjoyable, personalised, and normalising, and of it offering flexible interpersonal support. This is in line with previous findings [27,37,42-44]. This led us to consider how to augment conventional therapy with novel working mechanisms that would achieve these aims. The adoption of a webapp and mobile app were critical to improving the accessibility of therapy, and the use of personalisation, ambient information and visual metaphors provided a step change in therapy delivery to assist learning, monitoring and coping [36-37]. SlowMo therapy is presented as a journey that supports people to notice the large, fast spinning, grey worry bubbles that fuel distress, and make use of slow spinning, coloured bubbles to shrink fears and feel safer. These design features aim to nudge people to engage in reflective, slow thinking; they make slowing down easier as the interface reduces cognitive demands by providing an 'extended mind resource' [17]. These nudges, based on people's inherent preferences, aim to boost behaviour change by enhancing agency and competence, so that slower thinking continues even in the absence of the SlowMo interface [65]. This raises the interesting question of what degree of adherence, particularly to the mobile app, may be necessary to achieve meaningful

change. Digital mental health research tends to assume that increased and persistent adherence is the optimum outcome [66]. However, for therapies such as SlowMo that aim to boost behaviour change, it may be more relevant to focus on encouraging usage sufficient for the internalisation of key insights and strategies.

The study appeared effective in integrating design thinking methods such as exploration of the problem context, reframing of the problem and concept development. Similarly, the inclusive, UCD techniques supported empathic understanding and shared ownership of the design process by multiple stakeholders [39,41]. However, sampling of ‘extreme’ users was inevitably constrained to those willing and able to participate in the design research. A further limitation of the study is the lack of integration of an implementation strategy within the therapy design. This is critical, given that most health technologies fail to scale-up, spread and be sustained, even where they are efficacious in randomised controlled trials. Following the NASSS (non-adoption, abandonment, scale-up, spread and sustainability) implementation model [67], the design of SlowMo has been tailored to address the domains of the problem, and its associated difficulties and sociocultural aspects. We have also made progress in considering the domains concerning the complexities in the technology, the value proposition for stakeholders and identifying what is required of users in order for them to adopt the system. However, even if SlowMo is found to be sufficiently usable and useful in our current trial, the domains relating to the involved organisations, wider societal systems, and its embedding and adaptation in health service care pathways present further complicated challenges that will need to be tackled.

We therefore do not consider SlowMo to be a finished product, but rather a nascent behavioural intervention technology [68] or technology-enabled service [69]. The fundamental cognitive and behavioural principles of SlowMo will not change, given the theoretical underpinning and the robust findings from our previous empirical work [17]. However, we are developing the therapy interface iteratively, in the context of our current trial, with the aim of moving towards a sustainable service. At this stage, we have funding for relatively minor, incremental changes. However, dependent on the trial outcomes, there are several target areas for further innovation, which may involve additional behaviour change principles. For example, the importance of flexible interpersonal support was highlighted in our design research. Whilst the current version of SlowMo allows for variations in the level of interpersonal support within sessions, there is significant scope to develop therapist and peer support functions further. Different formats of automated digital communication between sessions could be tested, such as embodied conversational agents, together with peer-based online support groups, instant messaging or digital rewards [70-72]. Connected to this, it would be helpful to explore whether gameification can provide an

additional nudge to support the ‘boosting’ impact of the therapy (i.e. increasing agency and competence), for instance through introducing competition and/or teamwork [73]. In line with participant feedback during the *discover* phase, we are currently conducting a sub-study to investigate the feasibility of integrating into the platform a wearable device for detecting stress through biofeedback. This might ultimately provide timely, real-world interventions during difficult periods. Interoperability with existing electronic healthcare systems and integration within care pathways is likely to be important for successful implementation, and requires sensitive tailoring to clinicians’ needs and those of the wider system. A simpler, streamlined therapy flow could be developed for people where the usability of the standard SlowMo platform remains a challenge, together with an integrated instructional guide to support therapist training. From an agile science perspective, SlowMo could be implemented as a module within a broader digital therapy platform, with its intuitive monitoring function used to personalise intervention selection to the individual [42,74]. As mentioned, the bubble metaphor and interface is also applicable to a range of other difficulties and settings, and we are currently testing the feasibility of a standalone version of the app, Mo, to support stress management and wellbeing in the general population.

In conclusion, this study is the first to demonstrate how an inclusive UCD method (which privileges the involvement of a wider range of service users than in conventional participatory design) can enhance the usability of therapy and augment developments in psychological theory and interventions. We hope that our work may serve as a prototypical example of how design thinking can challenge skeuomorphism in digital health, whereby therapy features made redundant by technology are unnecessarily replicated (e.g. digitally replicating pen and paper tools such as thought records) instead of facilitating psychological mechanisms of change through innovative digital means. Notwithstanding the hugely valuable progress made over the past two decades in psychological therapy for psychosis [1], we echo recent calls to shift the frame of therapy radically in order to address the fundamental paradox that evidence-based psychological interventions are often not sufficiently helpful to bring about meaningful change [39,64,68,75]. We recommend the adoption of inclusive, UCD methods to develop novel digital solutions that embed psychological principles into daily life.

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Conflict of interest

The authors declare no conflicts of interest.

Multimedia Appendix

Multimedia Appendix 1. Screenshots of the Thinking Well therapy.

Multimedia Appendix 2. Design research processes and outputs from the discover phase.

Multimedia Appendix 3. Design research processes and outputs from the develop phase.

Multimedia Appendix 4. Screenshots of the SlowMo webapp from the deliver phase.

Multimedia Appendix 5. Screenshots of the SlowMo app from the deliver phase.

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